

**AMENDMENTS TO THE SPECIFICATION**

**Please replace the paragraph no. [0002] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

Conventionally, various 2-~~freedom~~-degree of freedom controls have been proposed for a method of improving both a command following characteristic and a disturbance response characteristic. Means capable of easily designing the command following characteristic and the disturbance response characteristic independently has been disclosed in JP-B-7-21724.

**Please replace the paragraph no. [0003] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

Referring to this method, there has been described that a feedback system is constituted in a controlled object simulating circuit for simulating a controlled object in addition to a conventional feedback control system, and a 2-~~freedom~~-degree of freedom control system is constituted for the controlled object by using a simulating input signal sent to the controlled object simulating circuit and a simulating output signal obtained from the controlled object simulating circuit.

**Please replace the paragraph no. [0011] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

In order to solve the problems, a first invention is directed to an optimum command producing apparatus for inputting a command, processing the command in such a manner that a control object implements a desirable operation and outputting an optimum command value to a

servo control apparatus, comprising an N-order filter processing section for carrying out an N-order filter processing for the command and calculating values from a ~~1-rank~~ 1<sup>st</sup> order differential to an ~~(N-1)-rank~~ (N-1)<sup>th</sup> order differential of the command subjected to the filter processing, and an arithmetic unit for adding a value obtained by multiplying an output of the N-order filter processing section by a gain, and furthermore, a second invention is directed to an optimum command producing apparatus for inputting a command, processing the command in such a manner that a control object implements a desirable operation and outputting an optimum command value to a servo control apparatus, comprising an N-order filter processing section for carrying out an N-order filter processing for the command and calculating values from a ~~1-rank~~ 1<sup>st</sup> order differential to an ~~(N-1)-rank~~ (N-1)<sup>th</sup> order differential of the command subjected to the filter processing, an arithmetic unit for adding a value obtained by multiplying an output of the N-order filter processing section by a gain, and an M-order filter processing section for carrying out an M-order filter processing over respective variables output from the arithmetic unit again.

**Please replace the paragraph no. [0012] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

Moreover, a third invention is directed to an optimum command producing apparatus for inputting a command, processing the command in such a manner that a control object implements a desirable operation and outputting an optimum command value to a servo control apparatus, comprising an N-order filter processing section for carrying out an N-order filter processing for the command and calculating values from a ~~1-rank~~ 1<sup>st</sup> order differential to an ~~L-rank~~ L<sup>th</sup> order differential of the command subjected to the filter processing, and an arithmetic

unit for multiplying, by a gain, the values from the ~~L-rank~~ 1<sup>st</sup> order differential to the ~~L-rank~~ L<sup>th</sup> order differential to be outputs of the N-order filter processing section respectively and then adding all of them up.

**Please replace the paragraph no. [0013] of US Publication No. 2006/0015217 A1, with the following amended paragraph:**

Furthermore, an optimum command producing apparatus according to a fourth invention is characterized in that a value of L of the ~~L-rank~~ L<sup>th</sup> order differential is an order of a model for approximating the control object.

**Please replace the paragraph no. [0014] of US Publication No. 2006/0015217 A1, with the following amended paragraph:**

Moreover, an optimum command producing apparatus according to a fifth invention is characterized in that a recursive type filter or a non-recursive type filter is used for the N-order filter and an order N of the N-order filter is set to be an order or more which is necessary for converting the command to be ~~L-rank~~ L<sup>th</sup> order differentiable.

**Please replace the paragraph no. [0027] of US Publication No. 2006/0015217 A1, with the following amended paragraph:**

Herein,  $XL^{(a)}$  represents an ~~a-rank~~ a<sup>th</sup> order differential of the variable XL.

$$X_{ref} = XL + J2/K2 \cdot XL^{(2)} \quad \cdots (3)$$

$$V_{ref} = XL^{(1)} + J2/K2 \cdot XL^{(3)} \quad \cdots (4)$$

$$T_{ref} = (XL^{(2)} + J2/K2 \cdot XL^{(4)}) \cdot J1 + J2 \cdot XL^{(2)} \quad \dots (5)$$

**Please replace the paragraph no. [0028] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

In case of the control object having the 2-inertia system, accordingly, if there are values up to the ~~4-rank~~ 4<sup>th</sup> order differential of the load position XL, coefficients constituted by K2 and J2 are then multiplied and added up so that the motor position Xref, the speed Vref and the torque command Tref given to the motor which implement the optimum operation of the motor can be calculated.

**Please replace the paragraph no. [0030] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

In the embodiment, the control object 5 has the 2-inertia system. In order to obtain the optimum command value, therefore, it is necessary to convert the given command into a command which is ~~4-rank~~ 4<sup>th</sup> order differentiable. In order to correspond to the case in which a command cannot be differentiated (for example, a step command), therefore, the filter order N is to be 4 or more. Description will be given to an example in which N is set to be 5 in order to smoothly give a command.

**Please replace the paragraph no. [0036] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

Herein,  $XL_{sup.(1)}(k+1)$ ,  $XL_{sup.(2)}(k+1)$ ,  $XL_{sup.(3)}(k+1)$  and  $XL_{sup.(4)}(k+1)$  represent the values of  $XL(k+1)$  from a ~~1-rank~~ 1<sup>st</sup> order differential to a ~~4-rank~~ 4<sup>th</sup> order differential, respectively. Thus, the Equation (9) is executed so that the values of  $XL(k+1)$  from the ~~1-rank~~ 1<sup>st</sup> order differential to the ~~4-rank~~ 4<sup>th</sup> order differential are also calculated automatically.

**Please replace the paragraph no. [0038] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

In the case in which a positional shift is generated due to the precision problem in the calculation being carrying out by the calculator, it is also possible to carry out a processing of repeating a differential approximation N times as a method of calculating the variable  $XL(k)$  from a ~~1-rank~~ 1<sup>st</sup> order differential value to an ~~N-rank~~ N<sup>th</sup> order differential value after the filter processing.

**Please replace the paragraph no. [0039] of US Publication No. 2006/0015217 A1,  
with the following amended paragraph:**

For example, when the differential is approximated by using a difference, Equation (10) can be obtained. In order to make a distinction from the Equation (9), the ~~1-rank~~ 1<sup>st</sup> order differential value to the ~~N-rank~~ N<sup>th</sup> order differential value are represented by symbols of  $XL2^{(1)}(k)$ ,  $XL2^{(2)}(k)$ , ...,  $XL2^{(N)}(k)$ , respectively.

$$\begin{aligned}
 XL2^{(1)}(k) &= \frac{XL(k) - XL(k-1)}{Ts} \\
 XL2^{(2)}(k) &= \frac{XL2^{(1)}(k) - XL2^{(1)}(k-1)}{Ts} & \dots (10) \\
 &\vdots \\
 &\vdots \\
 XL2^{(N)}(k) &= \frac{XL2^{(N-1)}(k) - XL2^{(N-1)}(k-1)}{Ts}
 \end{aligned}$$

**Please replace the paragraph no. [0052] of US Publication No. 2006/0015217 A1, with the following amended paragraph:**

FIG. 4 is different from FIG. 1 for explaining the first embodiment in only one portion. A value subjected to an N-order filter processing is not obtained from a ~~1-rank~~ 1<sup>st</sup> order differential to an ~~(N-1)-rank~~ (N-1)<sup>th</sup> order differential but a value L is newly defined and is obtained from the ~~1-rank~~ 1<sup>st</sup> order differential to an ~~L-rank~~ L<sup>th</sup> order differential, and is input to an arithmetic unit 2. The value of the variable L is set to correspond to the order of a model for approximating a control object.

**Please replace the paragraph no. [0053] of US Publication No. 2006/0015217 A1, with the following amended paragraph:**

For example, in the case in which an optimum command is to be created for a control object having a 2-inertia system, it is sufficient that a command is obtained up to a ~~4-rank~~ 4<sup>th</sup> order differential value as described above. This is equivalent to the fact that the order of the

control object having the 2-inertia system is four. More specifically, the value of L is four in this case.

**Please replace the paragraph no. [0055] of US Publication No. 2006/0015217 A1, with the following amended paragraph:**

For example, in the case in which a command given previously is ~~2-rank~~2<sup>nd</sup> order differentiable, it is sufficient that the filter order N is two or more.

**Please replace the paragraph no. [0058] of US Publication No. 2006/0015217 A1, with the following amended paragraph:**

When a signal obtained by carrying out the N-order filter processing over an input command and values from a ~~1-rank~~1<sup>st</sup> order differential to an ~~L-rank~~L<sup>th</sup> order differential are set to be  $XL^{(0)}(k+1)$ ,  $XL^{(1)}(k+1)$ ,  $XL^{(2)}(k+1)$ , ...,  $XL^{(L)}(k+1)$ , an optimum command value is obtained as in Equations (16) to (18).

$$X_{ref} = G_{x0} \cdot XL + G_{x1} \cdot XL^{(1)} + \cdots + G_{xL} \cdot XL^{(L)} \quad \cdots (16)$$

$$V_{ref} = G_{v0} \cdot XL + G_{v1} \cdot XL^{(1)} + \cdots + G_{vL} \cdot XL^{(L)} \quad \cdots (17)$$

$$T_{ref} = G_{t0} \cdot XL + G_{t1} \cdot XL^{(1)} + \cdots + G_{tL} \cdot XL^{(L)} \quad \cdots (18)$$

**Please replace the paragraph no. [0064] of US Publication No. 2006/0015217 A1, with the following amended paragraph:**

Also in this case, the variable  $XL(k)$  from a ~~1-rank~~1<sup>st</sup> order differential value to an ~~N-rank~~N<sup>th</sup> order differential value cannot be obtained automatically. Therefore, it is

preferable that the differential processing of the Equation (10) should be carried out after a filter processing.